Gulls in the Central Pacific[1]

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PUBLISHED INFORMATION on the distribution of gulls in the central Pacific Ocean is limited to reports covering accidental or vagrant individuals of nine species. Reports for the central Pacific prior to 1961 were summarized by Bryan (1958) and Udvardy (1961), and all subsequent published records have appeared in *The Elepaio,* the journal of the Hawaiian Audubon Society (Walker, 1961; Bryan, 1962, 1964; Ord, 1962, 1963*a,* 1963*b,* 1963*c,* 1964). Papers by King (1955), Bourne (1965), and Fry (1966) present three gull records from other central Pacific islands.

Data collected through May 1966 increase our knowledge of gull distribution and provide the first quantified information on gull occurrence in the Hawaiian Islands. The 41 specimens of eight species and 50 other sight records more than double the number of gull records from the central Pacific. Biweekly field reports from Kure Atoll provide the first positive information on arrival and departure dates. Most of the new records from the Hawaiian Islands have been summarized by Clapp and Woodward (in press) and those from the Line Islands and Phoenix Islands by Clapp and Sibley (1967).

During 1963 the Pacific Ocean Biological Survey Program (POBSP) of the Smithsonian Institution began a study of the central Pacific area emphasizing bird distribution and movements. Investigators of the POBSP have visited most of the islands between latitudes 30°N and 10°S and longitudes 150°W and 180°W (i.e., the Hawaiian, Line, Phoenix, and Tokelau islands), maintained year-round field stations on Kure and Johnston atolls, and accumulated thousands of hours of pelagic observations.

We are greatly indebted to all members of POBSP who assisted in the collection of these data and to Mrs. Roxie Laybourne and Dr. Lester Short, U.S. National Museum, who identified some of the specimens.

RECORDS FROM THE HAWAIIAN ISLANDS

Ten species have been recorded in the literature: *Larus argentatus, L. californicus, L. delawarensis, L. glaucescens, L. hyperboreus, L. occidentalis, L. philadelphia, L. pipixcan,* and *Rissa tridactyla* as accidentals or occasional stragglers, *L. novae-hollandiae* as a zoo escapee and *L. occidentalis* as an introduction. Neither of the latter two species became established.

Table 1 presents data on all identifiable gull specimens collected through March 1966. In February and March of 1963, 12 gulls of three species were collected in the Leeward Hawaiian Islands. At least 8 other gulls were seen (6 on Midway and 2 on Kure), and 3 unidentifiable carcasses were found on beaches (2 on Midway and 1 on Kure).

During the period September 1963 to July 1965 from one to three observers were present on Green Island, Kure Atoll, and species observations were made continuously. The 3-mile perimeter of the island was patrolled at least every third day and special emphasis was placed on the sighting and collection of gulls. Although gulls roosted on an isolated sand bar west of the island, they spent part of every day on Green Island and it is unlikely that many were overlooked during the two years of observation.

No gulls were seen on Kure Atoll during the winter of 1963–1964 and none were seen on a trip to the Leeward Hawaiian Islands in March 1964.

During the winter of 1964–1965 at least 22 individual gulls were present on Kure Atoll. The number sighted during each 2-week period and the minimum number for that period are presented in Table 2. The daily variation in

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TABLE 1

GULLS COLLECTED IN THE CENTRAL PACIFIC BY POBSP IN 1963–1966

USNM NO.	ISLAND	DATE	SEX	WEIGHT IN GRAMS
Larus argentatus vegae (Herring Gull)				
493348	Kure Atoll	10 Mar 1963	♀	1120
493349	Kure Atoll	10 Mar 1963	♀	1570
493350	Kure Atoll	10 Mar 1963	♀	970
494367	Kure Atoll	20 Jan 1965	♀	1006
494371	Kure Atoll	8 Mar 1965	♂	948
494374	Kure Atoll	1 Apr 1965	♀	909
494375	Kure Atoll	10 Nov 1964	♀	1090
493351	Midway Atoll	25 Feb 1963	♂	940
493352	Laysan Island	12 Feb 1963	♀	—
493353	Lisianski Island	14 Feb 1963	♀	—
493346	Pearl and Hermes Reef	27 Feb 1963	♂	—
493347	Pearl and Hermes Reef	5 Mar 1963	♀	—
Larus atricilla (Laughing Gull)				
493503	Johnston Atoll	7 Apr 1964	♂	365.8
493603	At sea, 12°41′N, 171°28′W	7 Mar 1964	♂	284
494981	At sea, 16°51′N, 169°40′W	15 Jan 1965	♀	287
493824	Christmas Island	22 Mar 1964	♂	414
493825	Christmas Island	22 Mar 1964	♀	311
493826	Christmas Island	22 Mar 1964	♀	353
493827	Christmas Island	22 Mar 1964	♂	—
493947	Palmyra Island	24 Nov 1964	♂	312.6
494089	Baker Island	14 Feb 1964	♂	—
Larus delawarensis (Ring-billed Gull)				
493342	Pearl and Hermes Reef	5 Mar 1963	—	—
494343	Kure Atoll	22 Feb 1963	♀	479
Larus glaucescens (Glaucous-winged Gull)				
493344	Kure Atoll	10 Mar 1963	♀	1230
494365	Kure Atoll	24 Dec 1964	♀	1483
494368	Kure Atoll	1 Feb 1965	♂	1270
494369	Kure Atoll	1 Mar 1965	—	1421
494370	Kure Atoll	7 Mar 1965	♂	1204
494372	Kure Atoll	9 Mar 1965	—	1248
493345	Pearl and Hermes Reef	26 Feb 1963	♂	—
494131	Pearl and Hermes Reef	18 Mar 1965	—	1432
494132	Pearl and Hermes Reef	18 Mar 1965	♀	1515
494133	Lisianski Island	12 Mar 1965	♂	1700
Larus hyperboreus (Glaucous Gull)				
494366	Kure Atoll	17 Jan 1965	♂	1575
Larus pipixcan (Franklin's Gull)				
496203	French Frigate Shoals	4 Aug 1965	—	dried carcass
496505	Palmyra Island	15 May 1966	♀	—
496506	Palmyra Island	13 May 1966	♀	—

TABLE 1 (*continued*)

USNM NO.	ISLAND	DATE	SEX	WEIGHT IN GRAMS
Larus schistisagus (Slaty-backed Gull)				
494373	Kure Atoll	9 Mar 1965	♂	973
Rissa tridactyla (Black-legged Kittiwake)				
494296	Kure Atoll	30 Dec 1964	♀	317.5
496205	Pearl and Hermes Reef	15 Mar 1965	—	dried carcass
496206	Pearl and Hermes Reef	19 Mar 1965	—	dried carcass

gull numbers and the collection of 5 individuals in early March, when no more than 3 were seen on any one day, would indicate a frequently changing population. Therefore more than 22 gulls may have visited the island during the winter. All sight identifications given in Table 2 are questionable since immature gulls are difficult to identify in the field. During two trips to the Leeward Hawaiian Islands, 6 gulls of three species were collected—5 birds in March and 1 in August.

Observers present on Johnston Atoll between July 1963 and March 1966 saw only 3 gulls, one of which was collected. In addition, 2 specimens were collected at sea, 11 miles and 300 miles south of Johnston Atoll.

No comparable data are available from the main Hawaiian islands, but since 1961 (during the winter months, December to March) observations of six species have been reported in *The Elepaio* (Walker, 1961; Bryan, 1962, 1964; Ord, 1962, 1963*a*, 1963*b*, 1963*c*, 1964).

Gulls probably occur irregularly during the winter on all of the Hawaiian islands but more frequently on the leeward than on the main islands. An unexplained fluctuation in numbers and species occurs from year to year. During the winters of 1962–1963 and 1964–1965, considerable numbers of gulls were present in the Leeward Hawaiian Islands; in 1963–1964, none. *Larus argentatus* and *L. glaucescens*, the most abundant species, were not equally common during the two good winters. In 1962–1963 *L. argentatus* outnumbered *L. glaucescens* eight to one, but in 1964–1965 the proportion was four to eight. Very few of the observations have been of adult birds, and there have been no summer observations of living birds.

RECORDS FROM THE LINE AND PHOENIX ISLANDS

Only three published records existed for the Line and Phoenix islands. King (1955) reported an immature *Larus delawarensis* on Christmas Island from 15–17 November 1953, Bourne (1965) reported the sighting of "a few" *L. pipixcan* at Fanning Island in December 1963, and Fry (1966) reported a *L. occidentalis* on Fanning Island in July 1965.

Thrice-yearly trips were initiated to the Phoenix Islands in 1963 and to the Line Islands in 1964. Gulls were seen once in the Phoenix group and on four trips to the Line Islands. All six specimens collected in 1964–1965 (four on Christmas Island, one on Palmyra, one on Baker) were *L. atricilla* and all six sight records for this period (two from Palmyra, four from Fanning) were referred to this species (Clapp and Sibley, 1967). In May 1966 two *L. pipixcan* were collected on Palmyra Island, Line Islands.

DISCUSSION

Many authors have noted that gulls are generally absent from tropical oceanic islands. Their distribution is normally associated with continental areas or islands adjacent to large land masses, e.g., the Australasian region and the West Indies. Those gulls which habitually spend long periods at sea are restricted to the cold waters of the temperate and polar regions.

TABLE 2

BIWEEKLY GULL POPULATIONS ON KURE ATOLL DURING THE WINTER OF 1964–1965

DATE	GULLS SIGHTED	MINIMUM NO. OF NEW GULLS
Nov. 1–15	1 *Larus argentatus* collected No other gulls seen	1
Nov. 16–30	None	
Dec. 1–15	None	
Dec. 16–31	6 *L. glaucescens* seen, 1 collected, 2 banded 3 *Rissa tridactyla* seen, 1 collected	9
Jan. 1–15	7 *L. glaucescens* seen, none with bands 2 *L. hyperboreus* seen	6
Jan. 16–31	4 *L. glaucescens* seen 2 *L. hyperboreus* seen, 1 collected	0
Feb. 1–15	1 *L. glaucescens* collected 2 gulls seen, 1 carcass found	0
Feb. 16–28	1 *L. glaucescens* seen 2 *L. hyperboreus* seen	1
Mar. 1–15	3 *L. glaucescens* collected 1 *L. argentatus* collected 1 *L. schistisagus* collected No other gulls seen	4
Mar. 16–31	None	
Apr. 1–15	1 *L. argentatus* collected No gulls seen after April 1	1

The Galapagos Islands, with two breeding species, would appear to be the only true oceanic islands in the tropical latitudes that boast breeding colonies of gulls. The westward extension of the cool Peru current, however, exerts considerable influence on the marine fauna of these islands and they cannot be considered ecologically typical of the tropics. Our field investigations reveal that gulls frequently reach islands of the central Pacific during the winter. In some years one or more species is present in considerable numbers. The lack of breeding gulls in these islands cannot therefore be attributed to lack of potential colonizers.

Gull distribution in the central Pacific is presented, by species, in Table 3. Analysis of their normal breeding and wintering ranges reveals no particular pattern of dispersal. All Herring Gulls collected from the Leeward Hawaiian Islands have proven to be *Larus argentatus vegae.* This subspecies breeds only in Siberia and winters along the Asian coast of the Pacific, occasionally occurring on the American coast as far south as British Columbia. *L. schistisagus* occurs along the western Pacific shores from the Gulf of Anadyr to China and Formosa. Specimens of *Rissa tridactyla, L. glaucescens, L. philadelphia,* and *L. hyperboreus* could conceivably have originated from the North American coast. *L. delawarensis* and *L. californicus* breed in the plains of western North America and winter along the Pacific coast as far north as Washington and British Columbia. *L. pipixcan* breeds in the northern interior of North America. *L. atricilla* has the easternmost affinity, breeding on the Atlantic coast from Nova Scotia to Venezuela, the Gulf of Mexico, and southern California and Mexico on the Pacific coast, with some birds wintering on the Pacific coast from Mexico to South America.

The wide range in their probable origins and irregular appearance in the Hawaiian Islands suggests that wind drifting may be primarily responsible for their appearance.

Bryan (1964), Frings (1965*a,* 1965*b*), and Amadon (1965) have recently commented on possible factors restricting gull distribution. Frings presented several theories concerning the failure of gulls to colonize the Hawaiian Islands. These theories center on two main themes. The first is essentially non-adaptability to local food sources. He notes that gulls are essentially scavengers and depend on a rich source of dead or easily obtained food. Productivity of tropical waters is notoriously low and the molluscs and other invertebrates which are so abundant on the rocky beaches of the higher latitudes are almost totally absent. The second theme, and that which Frings believes most important, involves the functioning of the nasal glands and their role in salt excretion. He postulates that gulls must have access to fresh or brackish water

TABLE 3

DISTRIBUTION OF GULLS RECORDED IN THE CENTRAL PACIFIC[1]

°N Latitude	Island	Rissa tridactyla	Larus schistisagus	Larus argentatus	Larus delawarensis	Larus hyperboreus	Larus glaucescens	Larus philadelphia	Larus californicus	Larus pipixcan	Larus atricilla
28°	Kure	+	+	+	+	+	+				
28°	Midway			+			s	s			
27°	Pearl & Hermes	+		+	+		+				
26°	Lisianski			+			+				
25°	Laysan	+		+		+	+	+			
24°	French Frigate Shoals						s			+	
22°	Kauai					+		+			
21°	Oahu			+	s	s	s	s		s	
21°	Molokai				+						
21°	Maui					+		s	+	+	
20°	Hawaii			s	s	s	+	s	s		
17°	Johnston										+
6°	Palmyra									+	+
4°	Fanning									s	s
2°	Christmas				s						+
1°	Baker										+

+ - collected specimens
s - sight records only
1 - only species which have been substantiated by specimens are included. Sight records for these species on other islands are indicated.

for drinking purposes and that such water is usually totally lacking on Pacific islands.

Amadon replied to this article by pointing out that several species of gulls spend long periods at sea without suffering ill effects. He further argues that food availability would seem a more probable limiting factor. In addition, he postulates that competing tropical species and the apparent aerodynamic disadvantage of a gull over tropical oceans may also contribute to their lack of success.

Frings (1965*a*) cited a specimen of *Larus argentatus* which had washed ashore on Oahu and stated that most gulls arrive in the Hawaiian Islands in poor physical condition. This assumption is not supported by our data. Many gulls collected by POBSP personnel had considerable deposits of fat; the weights of these birds (Table 1) were within the range for immatures of each species; and all were wary and capable of strong flight. Although a large number of gulls visited Kure Atoll during the winter of 1964–1965, only one was found dead and it is believed to have died from gunshot wounds.

Not only were the Laughing Gulls from the Line Islands in good health, but there is some indication that they may have remained in the area for some months. Bourne (1965) reported a few "Franklin's Gulls" at Fanning Island in December 1963. These may have been the same birds observed and collected as Laughing Gulls (immature birds of the two species are very similar) in March 1964. An adult Laughing Gull in breeding plumage was seen over Palmyra in June 1964, and an adult in winter plumage was collected there in November 1964. On Johnston Island a Laughing Gull was present for two months before it was collected; a second bird which had been injured and apparently recovered was seen for almost two months before it disappeared.

Observations concerning the feeding habits of gulls in this area are fragmentary and inconclusive. The stomachs of most birds collected during the winter of 1962–1963 were empty or contained items obviously scavenged from garbage dumps. Gulls near Kure and Midway atolls habitually frequent the garbage dumps of the military facilities. The Laughing Gulls from the Line Islands contained local foods (analysis incomplete). While gulls as a group are voracious scavengers, many species are proficient at capturing live fish and other animals (Bent, 1921; Murphy, 1936).

Frings implied that all gulls reaching Hawaii fail to return to their place of origin and eventually die in the islands. However, those gulls which do reach the islands apparently do not remain long, and there are no summer records for gulls in Hawaii. Since they show no reluctance to depart, it would seem reasonable to assume they are not subjected to excessively stressful conditions at sea and probably will attempt to return to their normal summer range if navigational ability is unimpaired.

Since our observations recently have shown that some gulls arrive at the islands in apparent good health, and since Frings's birds were in poor physical condition, we are not able to agree with him that all gulls arriving at the islands after a long oceanic flight suffer from ionic imbalance and thirst, resulting in poor health, without the actual determination of body electrolytes.

Frings maintained that the salt glands of marine birds function primarily to rectify a given amount of sea water into a smaller amount of fresh water to satisfy their metabolic needs and that the elimination of excess salts ingested while feeding is to be considered a minor function. This view would seem to be contradictory to the reports of Schmidt-Nielsen et al. (1958) and Schmidt-Nielsen (1960) who found no evidence to support the hypothesis that sea birds must drink sea water in order to cover their normal needs for water. When his experimental birds were fed fresh fish the water content of the fish was more than adequate for the renal elimination of salts and nitrogen. He observed nasal secretion only after an osmotic load and never in fasting birds or after ingestion of fish or fresh water.

Frings pointed out that gulls are unable to concentrate sodium chloride in their salt gland secretion to the degree known in albatrosses and petrels (800–1100 meq/1). He feels, therefore, that gulls are unable to exist for long periods without recourse to fresh or brackish water. It would seem, however, that the salt-eliminating capability of the two species of gulls tested by Schmidt-Nielsen (*Larus argen-*

tatus, 600–800 meq/1; *L. marinus* 700–900 meq/1) is sufficient to allow them to exist on sea water (500–550 meq/1) even if their diet was restricted to isotonic marine invertebrates. Brewster (1883) even reported a captive Kittiwake (*Rissa tridactyla*) which refused fresh water but drank salt water eagerly.

Even if gulls did require a source of fresh or brackish water, this is available on most of the Hawaiian islands and on several of the Line islands. Many of the main Hawaiian islands have a high annual rainfall and permanent bodies of fresh or brackish water. Palmyra Island, although a low-lying atoll, has over 100 inches of rain a year, and there are enough pools of fresh water to support a population of toads (*Bufo marinus*). Washington Island also has over 100 inches of rain which maintains a large fresh water lake in the interior of the island. Thus we believe that the known physiological capabilities of gull salt glands are sufficient evidence to reject the theory that the salt glands are a limiting factor in the adaptation of gulls to these islands.

The failure of gulls to colonize tropical islands remains a puzzle. We have presented evidence that a number of species may winter in the central Pacific, and we have questioned several theories concerning their failure to establish breeding colonies in this area. Part of the answer may lie in the ease with which gulls arrive at, and presumably depart from, the islands. With the exception of the Laughing Gull, all of the species recorded from these islands breed at more northerly latitudes. Rather than being accidental (i.e., lost) birds, they may represent irregular migrants. Perhaps the question is not why gulls have failed to colonize tropical islands, but why migrants rarely establish breeding populations on their wintering grounds.

SUMMARY

Data collected from February 1963 to May 1966 by the Pacific Ocean Biological Survey Program on gull distribution in the central Pacific are presented. The 41 specimens and over 50 sight records indicate that *Larus argentatus* and *L. glaucescens* are the most frequent visitors in the Hawaiian Islands, *L. atricilla* and *L. pipixcan* in the Line Islands. Wind drifting is presumed to be primarily responsible for the arrival of gulls on central Pacific islands.

Gulls do not necessarily arrive at the islands in poor condition as previously believed, nor do they seem to remain on any one island for long. Garbage dumps are an important food source in the Hawaiian Islands but gulls in the Line Islands survive without access to any but local foods. Evidence is presented to show that a gull's salt glands are not a limiting factor in its survival on central Pacific islands.

It is proposed that gulls are irregular winter visitors to the Hawaiian Islands and that most of them return to their nesting grounds.

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